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Sasaki

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(54) **RECORDING APPARATUS**

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B41J 11/00 (2006.01)
B41J 11/06 (2006.01)

(52) **U.S. Cl.**

CPC ***B41J 11/002*** (2013.01); ***B41J 11/06*** (2013.01)

(58) **Field of Classification Search**

CPC B41J 2/01; B41J 11/002; B41J 29/38
USPC 347/102
See application file for complete search history.

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(57) **ABSTRACT**

A recording apparatus includes: a recording head that ejects fluid onto a recording medium; a supporting member that supports the recording medium; and a heating device that heats the supporting member, in which a supporting surface that supports the recording medium in the supporting member has a surface treatment layer having a radiation factor of 0.85 or more.

6 Claims, 3 Drawing Sheets

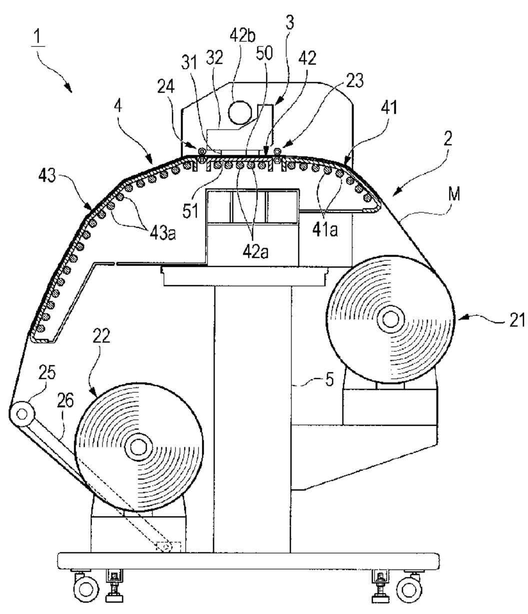


FIG. 1

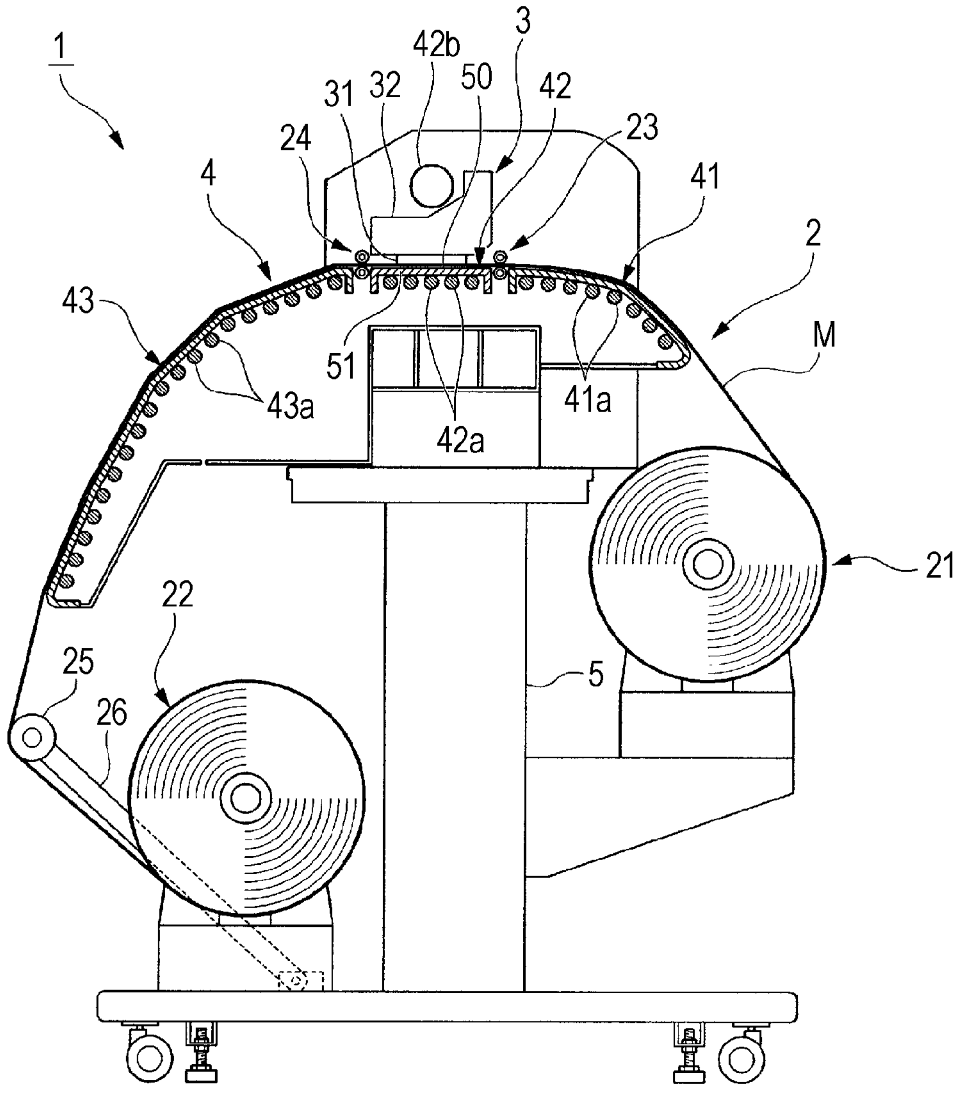


FIG. 2

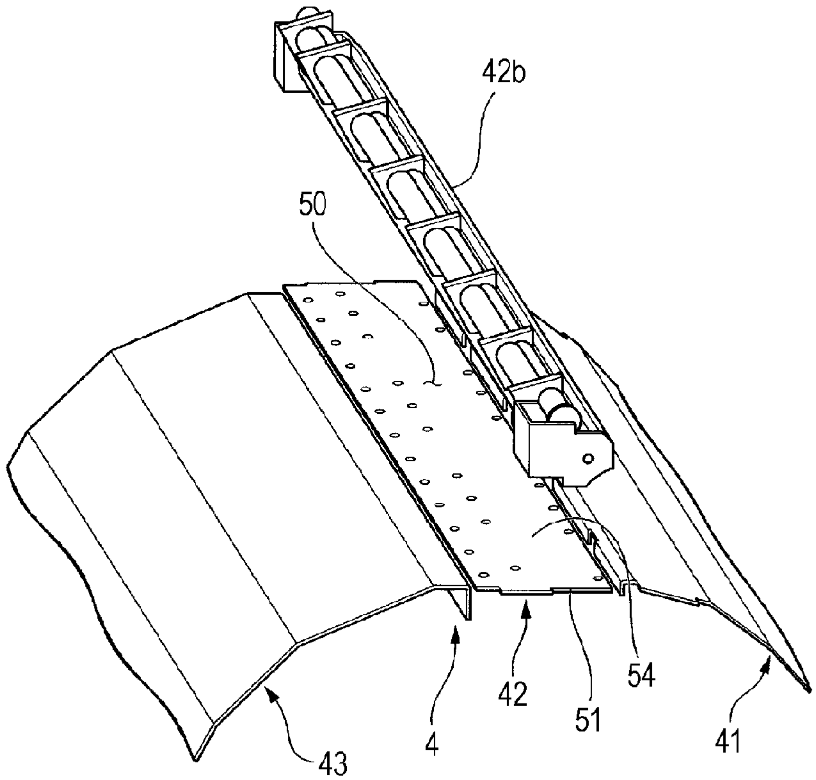


FIG. 3

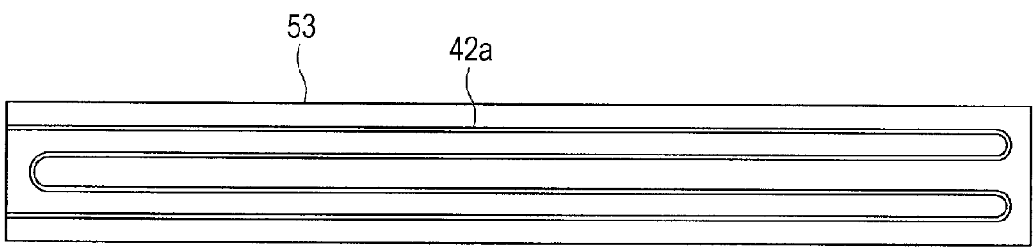


FIG. 4A

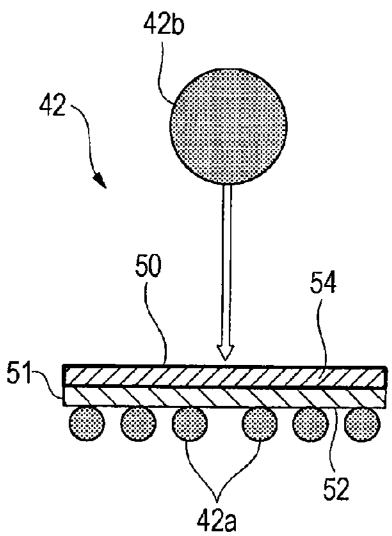


FIG. 4B

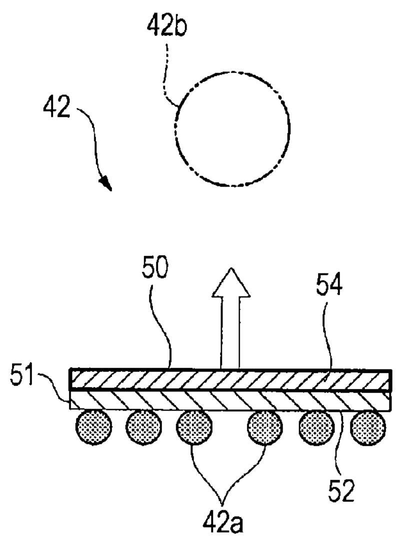
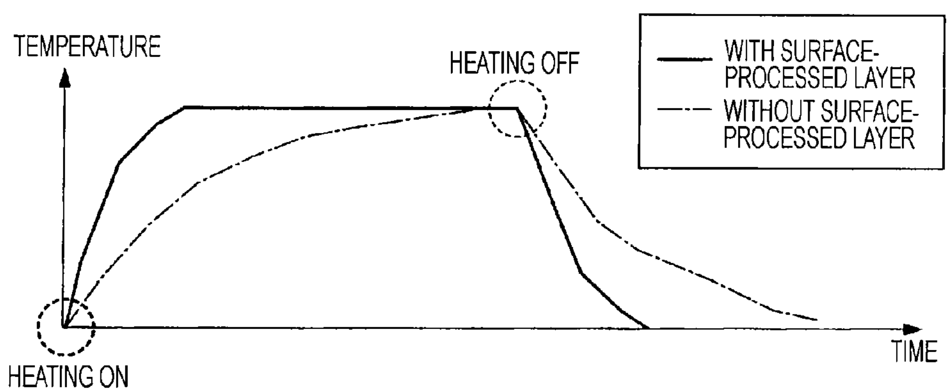


FIG. 5



RECORDING APPARATUS

The entire disclosure of Japanese Patent Application No: 2010-288114, filed Dec. 24, 2010 is expressly incorporated by reference herein in its entirety.

BACKGROUND

1. Technical Field

The present invention relates to a recording apparatus.

2. Related Art

An ink jet printer is known as a type of recording apparatus that records images or characters by ejecting fluid onto a recording medium. In the ink jet printer, when ink (fluid) that needs permeation drying or evaporation drying is used, there is need for a heating device to be provided to dry the ink ejected on the recording medium.

An ink jet recording apparatus disclosed in JP-A-2000-225696 is known as such a recording apparatus. The ink jet recording apparatus employs a section equipped with an infrared heater to heat the rear side of the recording surface of a recording medium and an infrared reflecting member at a position opposite to the infrared heater, and indirectly supplies infrared energy to the recording medium by using reflection. Further, it is preferable that the emissivity (radiation factor) of the infrared reflecting member be equal to or less than 0.1 when employing the unit.

However, the section in JP-A-2000-225696 does not directly supply infrared energy onto the recording surface of a recording medium, such that energy loss occurs and the ink may solidify and adhere to the nozzle due to radiation of the infrared energy to the nozzle plate that is ink ejecting portion. Further, in the section in JP-A-2000-225696, thermal responsiveness is poor particularly at the infrared reflecting member, a large amount of power is necessary to increase the temperature to a predetermined level, and it takes time for the heat to dissipate after being used.

SUMMARY

An advantage of some aspects of the invention is to provide a low power recording apparatus having a superior thermal responsiveness.

According to an aspect of the invention, there is provided a recording apparatus including: a recording head that ejects fluid onto a recording medium; a supporting member that supports the recording medium; and a heating device that heats the supporting member, in which a supporting surface that supports the recording medium in the supporting member has a surface treatment layer having a radiation factor of 0.85 of more.

According to the configuration, the supporting member having a surface treatment layer having a radiation factor of 0.85 or more on the supporting surface supporting the recording medium is heated. When the supporting member is a heat-receiving side, heat storage effect is achieved in the surface treatment layer due to heat absorption, contributing to a reduction in start-up time and power savings. On the contrary, when the supporting member is a heat-discharging side, heat discharging performance is increased by the radiation factor of the surface treatment layer and thermal responsiveness is improved.

Further, in the apparatus, the heating device may be disposed at a position opposite to the surface treatment layer and may include a radiation-heating unit that radiation-heats the surface treatment layer.

According to the configuration, since the radiation heating unit is disposed opposite to the surface treatment layer, it is possible to radiation-heat the surface treatment layer of the supporting member and also to directly heat the recording medium, thereby reducing energy loss.

Further, in the apparatus, the radiation heating unit may include an infrared heater having a wavelength which includes a region of 2 to 4 μm at the main portion of the peak of a radiation spectrum.

According to another aspect of the invention, absorption efficiency of infrared energy in water molecules is increased and radiation heating is implemented with a wavelength which includes a region of 2 to 4 μm at the main portion of a peak of a radiation spectrum, such that it is possible to vibrate the water molecules contained in the fluid, such as ink, and rapidly encourage drying due to the friction heat, without significantly increasing the temperature of the peripheral members which do not contain water molecules.

Further, the surface treatment layer may have a black alumite-processed layer.

According to still another aspect of the invention, the radiation factor of the surface treatment layer is 0.85 or more by the black alumite process.

Further, the heating device may be disposed on a surface opposite to the supporting surface of the supporting member and may include a heat-transfer/heating unit that transfers heat to the supporting member.

According to still another aspect of the invention, the heat-transfer/heating unit that transfers heat from the surface opposite to the supporting surface is provided, other than the radiation heating unit, such that the temperature of the support member is managed.

Further, the recording head may be disposed at a position opposite to the surface treatment layer.

According to still another aspect of the invention, since the recording head is disposed at the same side as the radiation heating unit, it is possible to prevent the fluid ejecting unit from being heated and the fluid from thickening and sticking.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

FIG. **1** is a view showing the configuration of a printer according to an embodiment of the invention.

FIG. **2** is a perspective view showing the configuration of a platen heater unit according to an embodiment of the invention.

FIG. **3** is a plan view showing the configuration of a heater according to an embodiment of the invention.

FIGS. **4**A and **4**B are schematic views illustrating the operation of a platen heater unit according to an embodiment of the invention.

FIG. **5** is a graph illustrating heating and temperature rising effect of a platen according to an embodiment of the invention.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

Embodiments of a recording apparatus of the invention are described with reference to the drawings. Further, the scales of the members are appropriately changed such that the members can be recognized in the drawings used for the following description. An ink jet type printer (hereafter, simply referred to as a printer) is exemplified in the embodiment as a recording apparatus of the invention.

FIG. **1** is a view showing the configuration of a printer **1** according to an embodiment of the invention.

The printer **1** is a large format printer (LFP) handling relatively large media (recording media) M. The medium M of the embodiment is implemented by a vinyl chloride series having a width of, for example, 64 inches.

As shown in FIG. **1**, the printer **1** includes a transporting unit (transporting device) **2** that transports the medium M in a roll-to-roll method, a recording unit **3** that records images or characters by ejecting ink (fluid) onto the medium M, and a heating unit (heating device) **4** that heats the medium M. The units are supported by a main body frame **5**.

The transporting unit **2** includes a roll **21** that discharges a rolled medium M and a roll **22** that winds the discharged medium M. The transporting unit **2** includes a pair of transporting rollers **23** and **24** that transport the medium M on a transporting path between the rolls **21** and **22**. Further, the transporting unit **2** includes a tension roller (tensing device) **25** that applies tension to the medium M on the transporting path between the paired transporting roller **24** and the roll **22**.

The tension roller **25** is supported by an oscillation frame **26**, in contact with the rear side of the medium M in the width direction (perpendicular to the page in FIG. **1**). The tension roller **25** is formed longer in the width direction than the width of the medium M. The tension roller **25** is disposed further to the downstream side in the transporting direction than the after-heater unit **43** of the heating unit **4**, which is described below.

The recording unit **3** includes an ink jet head (recording head) **31** that ejecting ink (fluid) onto the medium M on the transporting path between the pair of transporting rollers **23** and **24** and a carriage that is equipped with the ink jet head **31** and freely reciprocates **32** in the width direction. The ink jet head **31** has a plurality of nozzles and can eject ink that needs permeation drying or evaporation drying, which was selected based on the relationship with the medium M.

The heating unit **4** heats the medium M, thus preventing bleeding and blurring and improves the image quality by rapidly drying and fixing the ink on the medium M. The heating unit **4** has a supporting surface that is a portion of the transporting path of the medium M, and heats the medium M on the supporting surface while bending and supporting the medium M protruding upward between the rolls **21** and **22**.

The heating unit **4** includes a preheater unit **41** that preheats the medium M further to the upstream side in the transporting direction from the position where the recording unit **3** is disposed, a platen heater unit **42** that heats the medium M, opposite to the recording unit **3**, and an after-heater unit **43** that heats the medium M further to the downstream side in the transporting direction from the position where the recording unit **3** is disposed.

In the embodiment, heating temperature of the heater **41***a* in the preheater unit **41** is set at 40° C. Further, in the embodiment, heating temperature of a heater **42***a* in the platen heater unit **42** is set at 40° C. (the desired treatment), the same as in the heater **41***a*. Further, in the embodiment, heating temperature of a heater **43***a* in the after-heater unit **43** is set at 50° C., higher than that of the heaters **41***a* and **42***a*.

The preheater unit **41** rapidly dries the ink from when the ink lands by gradually increasing the temperature of the medium M to a desired temperature (the temperature of the platen heater unit **42**) from room temperature. Further, the platen heater unit **42** allows the ink to land on the medium M with the desired temperature maintained, and encourages the ink to dry rapidly from when the ink lands.

Further, the after-heater unit **43** rapidly dries the remaining ink that lands on the medium M and not dried yet by increasing the temperature of the medium M higher than the desired temperature, and completely dries and fixes the placed ink onto the medium M at least before the medium is wound on the roll **22**.

Next, a characteristic configuration of the platen heater unit **42** according to the embodiment is described with reference to FIGS. **2** to **4**B.

FIG. **2** is a perspective view showing the configuration of the platen heater unit **42** according to an embodiment of the invention. FIG. **3** is a plan view showing the configuration of the heater **42***a* according to an embodiment of the invention. FIGS. **4**A and **4**B are schematic views illustrating the operation of the platen heater unit **42** according to an embodiment of the invention.

As shown in FIG. **2**, the platen heater unit **42** has a platen (supporting member) **51** having a supporting surface **50** supporting the medium M. The platen **51** is made of a metallic material, such as an Al material or an SUS material. The platen **51** of the embodiment is made of an Al material. The platen **51** is longer in the width direction than the width of the medium M and, in more detail, has a flat plate shape that is longer than a width of about 64 inches.

The heater **42***a* (heat-transfer/heating unit) shown in FIG. **3** is wired on the surface **52** (see FIGS. **4**A and **4**B) opposite to the supporting surface **50** of the platen **51**. As shown in FIG. **3**, the heater **42***a* is a tube heater and bonded to the opposite surface **52** of the platen **51** by an aluminum tape **53**. Therefore, the heater **42***a* transfers heat to the platen **51** by thermal conduction from the opposite surface **52** and indirectly heats the medium M supported on the supporting surface **50** from the rear side.

The heater **42***b* shown in FIG. **2** (radiation-heating unit) is disposed at the position opposite to the supporting surface **50** of the platen **51**. The heater **42***b* is an infrared heater and extends in the width direction of the platen **51**, at a predetermined distance from the supporting surface **50**. Therefore, the heater **42***b* radiation-heats the platen **51** by directly radiating infrared energy on the supporting surface **50** and directly radiation-heats the recording surface side of the medium M when the medium M is supported on the supporting surface **50**.

The heater **42***b* radiates electromagnetic waves having a wavelength which includes a region of 2 to 4 μm at the main portion of a peak of a radiation spectrum. Therefore, the heater **42***b* can vibrate the water molecules contained in the ink and rapidly dry the ink by using the friction heat, without increasing temperature of the peripheral components that do not contain water molecules. Accordingly, it is possible to intensively heat the ink landed on the recording surface rather than the medium M by absorbing most of the infrared energy into the ink.

The ink jet head **31** (see FIG. **1**) is disposed at the position opposite to the supporting surface **50**. The ink jet head **31** has a positional relationship that it is disposed between the supporting surface **50** and the heater **42***b*, and is mounted on the carriage **32** to reciprocate in the width direction therebetween. Accordingly, infrared energy is not radiated to the nozzle plate that is the ink discharge portion of the ink jet head **31**, such that it is possible to prevent the ink from solidifying and adhering to the nozzle. Further, as a thermal countermeasure, the carriage **32** is provided with, for example, an insulator, because infrared energy is radiated thereto.

As shown in FIGS. **4**A and **4**B, the supporting surface **50** of the platen **51** has a surface treatment layer **54** having a radiation factor of 0.85 or more. The surface treatment layer **54** in the embodiment is formed by applying a black alumite process to a surface of the platen **51** made of an Al material. Specifically, the surface treatment layer **54** has a black alumite-processed layer formed by applying a black delustering alumite process.

Further, when the platen **51** is made of another metallic material, such as mild steel (radiation factor: 0.05) or stainless steel (radiation factor: 0.1), it is possible to make the radiation factor at 0.85 or more by using a surface coating process (for example, a black lacquer process). Further, a ceramic coating may be employed as the surface coating process.

As shown in FIG. **4**A, when a heating source (for example, heater **42***b*) having temperature that is equal to or more than the temperature of the platen **51** is provided, the platen **51** is a heat-receiving side for the radiation energy. Due to the radiation factor of the surface treatment layer **54**, the temperature rising effect of the platen **51** that is a heat-receiving side is increased, such that the temperature of the platen **51** is increased to predetermined temperature and the medium M on the platen **51** can be heated using a small amount of power.

As shown in FIG. **4**B, when a heating source (for example, heater **42***b*) having a temperature that is equal to or more than the temperature of the platen **51** is turned off or not provided, the platen **51** is a heat-discharging side for the radiation energy. The surface treatment layer **54**, due to the radiation factor thereof, increases the radiation energy discharged to the periphery of the platen **51** that is a heat-discharging side and increases the heat-discharging effect to more than the normal state, such that it is possible to provide superior thermal responsiveness.

Further, when the entire platen **51** is made of a heat storage material, the response to the discharging of heat is deteriorated. However, when only the supporting surface **50** of the platen **51** is the surface treatment layer **54**, the heat storage effect is achieved only in operation (for example, when the heater **42***b* is turned on) while conversely, the heat discharging effect is achieved in non-operation, such that a mechanism having high thermal response is implemented.

As known in the related art, the relationship between radiation energy E, radiation factor ϵ, and temperature T is expressed as the following Formula 1. Further, σ is the Stefan-Boltzmann constant.

$$E=\epsilon\times\sigma\times T^4 \tag{1}$$

As expressed by Formula 1, the radiation energy is proportionate to the radiation factor and fourth power of the temperature, such that contribution of the radiation factor is large. Accordingly, it is necessary to make the radiation factor of the surface treatment layer **54** at 0.85 or more in order to achieve the operation described above. On the other hand, when the radiation factor of the surface treatment layer **54** is less than 0.85, the operation is insufficient.

Next, the operation of the platen heater unit **42** having the configuration described above and the heating and temperature rising effect of the platen **51** are described with further reference to FIG. **5**.

FIG. **5** is a graph illustrating heating and temperature rising effect of the platen **51** according to an embodiment of the invention. Further, the vertical axis is temperature and the horizontal axis is time in FIG. **5**. Further, the chain line indicates a temperature change of the platen **51** of the related art without the surface treatment layer **54** in FIG. **5**.

When a job instruction to start printing is input, the heating sources (heaters **42***a* and **42***b*) are driven in the platen heater unit **42** and the temperature of the platen **51** is increased to a predetermined temperature (40° C. in the embodiment) from the room temperature. In the platen **51**, the supporting surface **50** is radiation-heated by the heater **42***b* and the opposite surface **52** receives heat and is heated via thermal conduction by the heater **42***a*. In the process, since the platen **51** is a heat-receiving side with temperature lower than the heat sources, heat storage effect due to absorption of heat of the surface treatment layer **54** is achieved and the temperature can rapidly reach predetermined temperature. Accordingly, as clearly seen in comparison to the configuration without the surface treatment layer **54** shown in FIG. **5**, it is possible to contribute to a reduction in the start-up time and saving of power.

When the medium M is transported to the printing region on the supporting surface **50**, the printing by the ink jet head **31** is started. In this operation, it becomes difficult for the platen **51** to receive heat from the heater **42***b* because the supporting surface **50** is covered by the medium M, but the temperature is kept constant by receiving the heat from the heater **42***a*.

The ink jet head **31** is mounted on the carriage **32** and starts printing while reciprocating in the width direction. Since the heater **42***b* is disposed across the width direction above the carriage **32**, when the carriage **32** retracts from the ink-landing region, the ink-landing region is directly radiation-heated with a wavelength which includes a region of 2 to 4 μm at the main portion of the peak of a radiation spectrum. Accordingly, the water molecules contained in the placed ink vibrate, encouraging evaporation drying by the friction heat, and the ink is fixed without into the medium M without bleeding or the like occurring.

Since the heater **42***b* is disposed opposite to the surface treatment layer **54**, the surface treatment layer **54** of the platen **51** can be radiation-heated and the medium M can also be directly heated, thereby reducing energy loss. Further, since the ink jet head **31** is also disposed at the same side as the heater **42***b*, it is possible to avoid the nozzle plate from being heated and the ink from thickening and sticking, as happens in the related art.

When a finish print job instruction is input, the heating sources (heaters **42***a* and **42***b*) in the platen heater unit **42** are stopped and the temperature of the platen **51** is decreased from the predetermined temperature to the room temperature. In this process, since the platen **51** is a heat-discharging side with temperature higher than the periphery, the surface treatment layer **54**, due to the radiation factor thereof, increases the radiation energy discharged in the periphery of the platen **51**, thereby increasing the heat discharging effect. Accordingly, as clearly seen in comparison to the configuration without the surface treatment layer **54** shown in FIG. **5**, thermal responsiveness is superior. Therefore, after the print job is finished, the temperature of the platen **51** rapidly decreases, such that it is possible to immediately adjust the temperature of the medium M to an appropriate temperature, for example, even if the material or size of the next-printed medium M is changed.

Therefore, according to the embodiment described above, in the printer **1** including an ink jet head **31** ejecting ink onto the medium M, the platen **51** supporting the medium M, and heaters **42***a* and **42***b* heating the platen **51**, the support surface **50** supporting the medium M of the platen **51** employs the configuration having the surface treatment layer **54** having a radiation factor of 0.85 or more, such that when the platen **51** is a heat-receiving side, heat storage effect is achieved in the surface treatment layer **54** by heat absorption and it is possible contribute to a reduction in start-up time and to save power, whereas when the platen **51** is a heat-discharging side, heat discharging performance is increased by the radiation factor of the surface treatment layer **54** and thermal responsiveness is improved.

Therefore, a low power printer **1** having a high thermal responsiveness is achieved in the embodiment.

Although a preferred embodiment of the invention was described above with reference to the drawings, the invention is not limited to the embodiment. The shapes or the combination of the components shown in the embodiment are an example and they may be changed in various ways on the basis of the desired design without departing from the spirit of the invention.

For example, in the embodiment, it is exemplified when the surface treatment layer **54** is disposed at the platen **51** of the platen heater unit **42**, but the surface treatment layer **54** may be disposed at the supporting member of another portion (for example, the preheater unit **41** or the after-heater unit **43**).

In the embodiment, although it is exemplified when the recording apparatus is the printer **1**, the recording apparatus is not limited to printers and may be a copy machine or a facsimile or the like.

Further, a recording apparatus that ejects or discharges another fluid, other than ink, may be employed as the recording apparatus. The invention may be used for various recording apparatuses including a recording head that discharges a small amount of droplets, for example. Further, droplets mean the state of fluid discharged from the recording apparatus, including a particle shape, a tear shape, and ones with a string-shaped tail. Further, the fluid should be a material that the recording apparatus can eject. For example, the material should be in a liquid state, like a fluid state such as: fluid with high or low viscosity, sol, gel water, other inorganic solvents, organic solvents, solution, liquid-state resin, liquid-state metal (metallic melt), including not only liquid as one state of the material, but a substance where particles of a functional material made of solid materials, such as a colorant or metal particles are dissolved, dispersed, or mixed in a solvent. Further, the ink described in the embodiment may be a typical example of the fluid. The ink includes various fluid compounds, such as common aqueous ink, oil-based ink, gel ink, and hot-melt ink. Further, the recording medium includes paper sheet, functional paper, substrate, and metal plate, other than plastic films, such as a vinyl chloride series-based film.

What is claimed is:

1. A recording apparatus comprising:

a recording head that ejects fluid onto a recording medium;

a supporting member that supports the recording medium; and

a heating device that heats the supporting member,

wherein a supporting surface that supports the recording medium in the supporting member has a surface treatment layer having a radiation factor of 0.85 or more,

wherein the surface treatment layer contacts with the recording medium when the supporting member supports the recording medium,

wherein the heating device includes a radiation heating unit that radiation heats the surface treatment layer from above the treatment layer and a heat-transfer heating unit that transfers heat to the surface treatment layer from below the surface treatment layer,

wherein when the radiation heating unit provides radiation heating energy to the top of the surface treatment layer and the heat-transfer heating unit provides heating energy to the bottom of the surface treatment layer, the surface treatment layer acts as a heat receiving side for the radiation heating energy that thereby heats the supporting member by absorbing and storing the heating energy, and

wherein when the radiation heating unit does not provide radiation heating energy to the surface treatment layer, the surface treatment layer acts as a heat discharging side that discharges heat energy that was absorbed and stored when the heating energy was provided.

2. The recording apparatus according to claim **1**,

wherein the radiation-heating unit includes an infrared heater having a wavelength which includes a region of 2 to 4 μm at the main portion of a peak of a radiation spectrum.

3. The recording apparatus according to claim **1**,

wherein the surface treatment layer has a black alumite-processed layer.

4. The recording apparatus according to claim **1**,

wherein the heating device is disposed on a surface opposite to the supporting surface of the supporting member.

5. The recording apparatus according to claim **1**,

wherein the recording head is disposed at a position opposite to the surface treatment layer.

6. A recording apparatus comprising:

a recording head that ejects fluid onto a recording medium;

a supporting member that supports the recording medium; and

a heating device that heats the supporting member,

wherein a supporting surface that supports the recording medium in the supporting member has a surface treatment layer having a radiation factor of 0.85 or more,

wherein the heating device includes an infrared heater having a wavelength which includes a region of 2 to 4 μm at the main portion of a peak of a radiation spectrum and a heat-transfer heating unit,

wherein the infrared heater is disposed opposite to the surface treatment layer and heats the surface treatment layer from above the treatment layer and the heat-transfer heating heats the surface treatment layer from below the surface treatment layer,

wherein when the infrared heater provides radiation heating energy to the top of the surface treatment layer and the heat-transfer heating unit provides heating energy to the bottom of the surface treatment layer, the surface treatment layer acts as a heat receiving side for the heating energy that thereby heats the supporting member by absorbing and storing the heating energy, and

wherein when the infrared heater does not provide radiation heating energy to the surface treatment layer, the surface treatment layer acts as a heat discharging side that discharges heat energy that was absorbed and stored when the heating energy was provided.

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